FMEA NO. 1.2.2

CRITICALITY 2/2

SHUTTLE CCTV
CRITICAL ITEMS LIST

UNIT Video Switching Unit (VSU)
OMG NO. 2294823-502, 504

SHEET 1 OF 7

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
No video output Causes: (1) Command failure on microprocessor, I/O, A1-2592389-501 or 2294889-502 (2) Timing logic, Logic board (VSU A3) 2592392-504 or 2294891-502 (3) Switch matrix short on output Amplifier A6, A7, or A8, 2294894-502 (4) Power bus short, all VSU boards	No video signal to any destination including on-board monitors and downlink. Worst Case: Loss of mission critical video.	DESIGN FEATURES The VSU is a microprocessor-based video switching unit using an RCA 1802 microprocessor, CMOS RAM, and TTL PROM. Computer I/O, decoding logic, digital audio and switch control circuitry are implemented in CMOS CD4000 series logic to minimize power dissipation. The design incorporates DMOS FET devices (SD211s) purchased to an RCA spec control drawing (SCD) as the basic video switch element. Video split-screen capability incorporates glass delay line modules procured from Microsonics (originally Corning) to an RCA SCD. The video amplifier design uses monolithic NE5539 wideband op amps in a fashion similar to the sync amp design employed in the RCU. Parts were required to be JAN reliability level parts of their equivalent. Part selection falls into three categories: (1) JAN or better parts from the Military QPL, (2) Parts demonstrated to NASA to be equivalent to JAN level via test data (e.g., CD4000/3W series parts), or (3) Parts procured to an RCA spec control drawing which calls out tests and screening to effect JAN equivalency. BARE BOARD DESIGN (A6, A7, A8) The design of the associated A6, A7, and A8 boards is constructed from laminated copper-clad epoxy glass sheets (NEMA G-10) Grade FR-4), PER MIL-P-55617A. Circuit connections are made through printed traces which run from point to point on the board surfaces. Every trace terminates at an annular ring. The annular ring surrounds the hole in which a component lead or terminal is located. This ring provides a footing for the solder, ensuring good mechanical and electrical performance. Its size and shape are governed by MIL-P-55640 as are trace widths, spacing and routing. These requirements are reiterated specifically in drawing notes to further assure compliance. Variations between the artwork master and the final product (due to irregularities of the etching process) are also controlled by drawing notes. This prevents making defective boards from good artwork. Holes which house no lead or terminal, but serve only to electrically interconnect the different board layers, contain stitch bars for mechanical support and increased reliability. The thru holes are drilled from a drill tape thus eliminating the possibility of human error and allowing tight control over hole and annular ring concentricity, an important reliability criterion. After drilling and etching, all copper cladding is tin-lead plated per MIL-STD-1495. This provides for easy and reliable soldering at the time of board assembly, even after periods of prolonged storage.

REVISED 5-7-87

FMEA NO. 1.2.2

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CRITICALITY 2/2

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REVISED 5-7-87

FMEA NO. 1.2.2

CRITICALITY 2/2

SHUTTLE CCTV
CRITICAL ITEMS LIST

UNIT Video Switching Unit (VSU)
DWG NO. 2294823-502, 504

SHEET 4 OF 7

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
No video output Causes: (1) Command failure on microprocessor, I/O, A1-2592389-501 or 2294889-502 (2) Timing logic, Logic board (VSU A3) 2592392-504 or 2294891-502 (3) Switch matrix short on output Amplifier A6, A7, or A8, 2294894-502 (4) Power bus short, all VSU boards	No video signal to any destination including on-board monitors and downlink. Worst Case: Loss of mission critical video.	QA/INSPECTION Procurement Control - The VSU Parts and hardware items are procured from approved vendors and suppliers, which meet the requirements set forth in the CCTV contract and Quality Plan Work Statement (WS-2593176). Resident DCAS personnel review all procurement documents to establish the need for GSE on selected parts (PAI 517). Incoming Inspection and Storage - Incoming Quality inspections are made on all received materials and parts. Results are recorded by lot and retained in file by drawing and control numbers for future reference and traceability. All EEE parts are subjected to incoming acceptance tests as called for in PAI 315 - Incoming Inspection Test Instructions. Incoming flight parts are further processed in accordance with RCA 1846684 - Preconditioning and Acceptance Requirements for Electronic Parts, with the exception the DPA and PIND testing is not performed. Mechanical items are inspected per PAI 316 - Incoming Inspection Instructions for mechanical items, PAI 305 - Incoming Quality Control Inspection Instructions, and PAI 612 - Procedure for Processing Incoming or Purchased Parts Designated for Flight Use. Accepted items are delivered to Material Controlled Stores and retained under specified conditions until fabrication is required. Non-conforming materials are held for Material Review Board (MRB) disposition. (PAI-307, PAI IQC-531). Board Assembly & Test - Prior to the start of VSU board assembly, all items are verified to be correct by stock room personnel, as the items are accumulated to form a kit. The items are verified again by the operator who assembles the kit by checking against the as-built-parts-list (ABPL). DCAS Mandatory Inspection Points are designated for all printed circuit, wire wrap and welded wire boards, plus harness connectors for soldering wiring, crimping, solder splices and quality workmanship prior to coating of the component side of boards and sleeving of harnesses. Specific VSU board assembly and test instructions are provided in drawing notes, and applicable documents are called out in the Fabrication Procedure and Record (FPR-2294823) and parts list PL 2294823. These include wire connection list 2295906, Process Standard RTV-566 2280881, Process Standard - Bonding Velcro Tape 2280889, Specification Soldering 2280749, Specification Name Plate Application 1960167, Specification - Crimping 2280800, Specification - Bonding and Staking 2280878, Specification - Urethane coating 2280877, Specification - locking compound 2026116, Specification Epoxy Adhesive 2010985, Specification - Marking 2280876, Specification - Workmanship 8030035, Specification Bonding and Staking 220075.

FMEA NO. 1.2.2

CRITICALITY 2/2

SHUTTLE CCTV
CRITICAL ITEMS LIST

UNIT Video Switching Unit (VSU)
DWG NO. 2294823-502, 509

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
No video output Causes: (1) Command failure on microprocessor, I/O, A1-2592389-501 or 2294889-502 (2) Timing logic, logic board (VSU A3) 2592392-504 or 2294893-502 (3) Switch matrix short on output Amplifier A6, A7, or A8, 2294894-502 (4) Power bus short, all VSU boards	No video signal to any destination including on-board monitors and downlink. Worst Case: Loss of mission critical video.	QA/INSPECTION (Continued) VSU Assembly and Test An open box test is performed per TP-IT-22944832, and an Acceptance Test per TP-AT-2294823, including vibration and thermal vacuum. Torques are specified and witnessed, traceability numbers are recorded and calibrated tools are check prior to use. RCA quality and DCAS inspections are performed at the completion of specified FPK operations in accordance with PAI-204, PAI-205, PAI-206, and PAI-217. DCAS personnel witness VSU button-up and critical torquing. RCA and DCAS personnel monitor acceptance tests and review test data/results. These personnel also inspect after all repair, rework and retest. Preparation for Shipment - The VSU is packaged according to 2200746. Process standard for packaging and handling guidelines. All related documentation including assembly drawing, parts list, ABPL, test data, etc. is gathered and held in a documentation folder assigned specifically to each assembly. This folder is retained for reference. An EIDP is prepared for each VSU in accordance with the requirements of MS-2593176. RCA QC and DCAS personnel witness crating, packaging, packing and marking, and review the EIDP for completeness and accuracy.

REVISED 5-7-87

FMEA NO. 1.2.2

CRITICALITY 2/2

SHUTTLE CCTV
CRITICAL ITEMS LIST

UNIT Video Switching Unit (VSU)
DWG NO. 2294823-502, 504

SHEET 6 OF 7

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
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CRITICALITY 2/2

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SHEET 7 OF 7

FAILURE MODE AND CAUSE	FAILURE EFFECT ON END ITEM	RATIONALE FOR ACCEPTANCE
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